

interview regarding the patentability of claims 1-4, the Examiner agreed to reconsider the sole remaining rejection (obviousness over Mack under § 103(a)) based on applicants' arguments. Applicants respectfully submit that in view of the applicable law and the deficiencies of the Mack reference, as discussed below, all remaining claims (1, 2 and 4) should be found allowable, and such action is requested.

In reviewing the pending claims, it was noted that claim 3 inadvertently duplicated claim 1, and claim 3 has been deleted, without prejudice, as unnecessary. Applicants also attach their request for additional time to respond pursuant to 37 CFR § 1.136(a).

## **II. SUMMARY OF APPLICABLE LAW**

The current rejection over Mack acknowledges (page 3) that Mack does not provide any express information as to a key characteristic recited in applicants' claims, namely the amount of occluded free bromine in a wet cake comprising water and decabromodiphenylethane product ("DBDPE"). Notwithstanding this clear deficiency in Mack, the Examiner suggests that Mack "may" inherently describe a wet cake of water and DBDPE having an occluded free bromine content within the claimed range and/or that, as a general proposition, one skilled in the art could adjust the amount of occluded free bromine in such a wet cake. Therefore, the Examiner believes that applicants must present some affirmative evidence that this is not the case.

Applicants respectfully submit that on the present record there is no basis for requiring a showing because the Examiner has not made (and cannot make) out a *prima facie* case of obviousness for the wet cakes claimed. Unless and until the Examiner has established a *prima facie* case of obviousness as required by law, applicants need not come forward with any evidence of nonobviousness.

We respectfully refer the Examiner to the MPEP, Section 2142, where the legal concept of *prima facie* obviousness is explained in detail with applicable illustrations and cited authority. As stated there

1. The concept of *prima facie* obviousness is a “procedural tool of examination” which “allocates who has the burden of going forward with production of evidence in each step of the examination process”;

2. The Examiner “bears the initial burden of factually supporting any *prima facie* conclusion of obviousness”;

3. If the Examiner “does not produce a *prima facie* case, the applicant is under no obligation to submit evidence of nonobviousness”; and

4. In determining whether a *prima facie* case of obviousness exists, the Examiner is cautioned that “impermissible hindsight must be avoided and the legal conclusion [of *prima facie* obviousness] must be reached on the basis of the facts gleaned from the prior art”.

MPEP §2142 further advises as follows regarding what is required before the Examiner can establish *prima facie* obviousness:

“To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant’s disclosure.”

See also MPEP §§2143 et seq and the legal authorities and factual examples there set forth.

With these admonitions from the MPEP and cited supporting case law in mind, applicants submit that the threshold issue becomes, has the Examiner in this case, on these facts, carried her burden to establish *prima facie* obviousness? For at least the reasons detailed below, applicants respectfully submit that no such case has been established. In short, and without limitation:

- (a) Mack is totally silent about the occluded free bromine content of his water/ DBDPE wet cakes;
- (b) To obtain the objectives of his invention, Mack relies upon an entirely different (as compared with applicants) aspect of the preparation of improved DBDPE's, namely the use of a high temperature treatment of recovered product with an aromatic solvent followed by recrystallation;
- (c) According to Mack, he does not need to take any special precautions or employ careful steps upstream of the aromatic solvent treatment to produce his desired products. Consequently, there are no recited steps in Mack to reduce occluded free bromine at any point in the Mack procedure and according to Mack, there is no need for such steps;
- (d) Mack does not teach any process having the step(s) recited by applicants to achieve a low occluded bromine content in the wet cake (especially the introduction of diphenylalkane reactant together with bromine);
- (e) Mack is not only silent regarding occluded free bromine content--such content is of no interest or concern to him, but he also provides no other data suggesting that inherently (or even sometimes accidentally) Mack's water/ DBDPE wet cake has applicants' claimed low bromine content; and
- (f) Applicants' comparative examples record the importance of process conditions and procedures to obtaining the claimed wet cakes (and that not just any process will provide the wet cakes claimed; depending on how it is made, a water/ DBDPE wet cake may have very different amounts of occluded free bromine).

Mack does not teach the importance of low occluded bromine wet cake levels. He does not try to control such content. He does not suggest applicants' levels of occluded free bromine (or any other level). He does not teach how to control such content and Mack does not care if it (or any upstream condition) is controlled or not.

Applicants now will discuss in further detail their claimed invention and the teachings of Mack, and why there is no showing here of a *prima facie* case of obviousness. However, another aspect of the applicable law requires mention. To the extent that the Examiner is relying on inherency in support of the rejection, two basic legal principles must be kept in mind.

1. Inherency means that an unstated result must necessarily, inevitably and always occur. Inherency does not exist if the result is accidental, unappreciated, occasional and only sometimes present. Mack certainly does not support a conclusion of inherency.

2. Inherency (if it exists at all) cannot be used to support an "obviousness" rejection. That which is not known at the time of the invention (i.e., only is inherent) cannot form a proper basis for an obviousness rejection. *See In re Shetly*, 195 U.S.P.Q. 753, 756-57 (CCPA 1977); *In re Spormann*, 150 U.S.P.Q. 449, 452 (CCPA 1996); *In re Pijckaert*, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993).

### III. APPLICANTS' CLAIMED INVENTION

Claims 1, 2 and 4 are presently pending. Claim 1 is the sole independent claim and it reads as follows:

"A wet cake comprising water and solid brominated diphenylethane product, which product contains a predominate amount of decabromodiphenylethane, the wet cake having an occluded free bromine content of from about 500 ppm to about 2000 ppm."

This claim defines a wet cake containing water and DBDPE, characterized by a low amount (about 500 ppm to about 2000 ppm) of occluded free bromine. The other dependent claims recite narrower ranges of bromine.

Although applicants' specification described an "improved process for the bromination of diphenylalkanes" (para. 0002), applicants also made it very clear that an important part of their described inventions was "the obtained wet cake [which] is most easily convertible to a high-quality ready-to-use flame-retardant product", one which "is characterized by having a lower occluded bromine content than that which is obtainable by prior processes" (para. 0005).

Applicants "theorized" in the application that the invention "favorably affects the crystallization of the [DBDPE]... so that there is a reduction in the formation of extremely small particles (fines) and so that there is an attenuation of the occluded free bromine content in the crystalline structure" (para. 0007).

As further explained in the specification, after unreacted and solvent bromine has been stripped off (para. 0041) and HBr, if any is present, has been neutralized (para. 0042), the liquid portion and the solid portion of the slurry are separated (para. 0043). The undried solids recovered from this separation comprise the "wet cake" (para. 0044).

Applicants further pointed out that the wet cakes of the invention are "unique in that they have a relatively low occluded free bromine content" (paras. 0045-46). This is further illustrated by the "Comparative Runs" which reported, *inter alia*, the occluded free-bromine content of the wet cake for the comparative runs (e.g., 2,007 to 5,463 ppm, avg. 3,773 ppm), and for the invention (838 ppm to 1,308 ppm, avg. 1,122 ppm) (paras. 0072-73).

Thus, from the very beginning, applicants emphasized the novelty and importance of the wet cakes described and demonstrated that comparative wet cakes had higher occluded free bromine content. Applicants are entitled to claim their novel and unobvious wet cakes just as they would be entitled to claim any new and unobvious intermediate in a chemical process.

#### IV. THE MACK REFERENCE--IN GENERAL

U.S. 5,457,248 (Mack) is directed to processes for preparing brominated diphenylalkane products said to be "far whiter than prior known brominated diphenylalkane products" (Abstract). Mack, however, expresses no concern about the condition of any "wet cake" that is formed by his process, and he does not describe the occluded free bromine content of any "wet cake" produced. In fact, Mack does not care about occluded free bromine content or its control because Mack relies on a special downstream recrystallation of the brominated diphenylalkane products from an aromatic solvent to achieve the whiter products of interest to him. This step of contacting the brominated diphenylalkane product with an aromatic solvent at above about 175°C to dissolve the product, followed by cooling to precipitate a product with improved color, is an essential (and expensive) downstream step in Mack (e.g., Col. 1, lines 44-64). Mack, therefore, expresses little concern about upstream process steps and, indeed, Mack affirmatively states that upstream steps traditionally employed to improve color, such as roasting or oven-aging, are unnecessary to his invention (Col. 7, lines 31-37).

In summary, Mack gives no hint that his process steps are at all concerned with, or in fact make, a water/ DBDPE wet cake with low occluded free bromine content. No occluded free bromine contents are described anywhere in the patent. The desirability of such a wet cake is not discussed or emphasized, especially because Mack relies on a downstream, high temperature aromatic solvent recrystallation to achieve his low color objectives. There is absolutely nothing

in Mack that would motivate anyone skilled in the art to examine or modify the Mack teachings to improve, change or even test the wet cake for any properties, much less occluded free bromine content. And there is nothing in Mack suggesting that the wet cake of Mack is any different from the routine type of wet cakes, with relatively high occluded free bromine content, of the kind referenced as prior art in applicants' specification and the subject of the comparative examples.

Except by hindsight, there is nothing in Mack would lead one skilled in the art to single out any aspect of Mack (except the assertedly critical aromatic solvent treatment), much less the wet cake, for study or modification or to consider any part of Mack as new or different (other than the recrystallation). Thus, there is no motivation to focus on the wet cakes of Mack, or to adjust their bromine content, or to experiment to see how such content could be reduced.

No case of *prima facie* obviousness can be made out using the Mack reference.

#### V. THE MACK REFERENCE--SPECIFIC TEACHINGS

Because nothing in Mack provides an occluded free bromine content for his water/DBDPE wet cake,<sup>2</sup> there is no basis on which to conclude that Mack inherently produces a wet cake as claimed. Moreover, the upstream process steps of Mack are different from those described by applicants (so there is no reason to suspect the bromine contents would be the same) and the analytical results that are provided in Mack do not suggest what the occluded free bromine content of the upstream wet cake might be, and especially that it is low. This is discussed below in connection with the Mack disclosure and teachings.

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<sup>2</sup> By "wet cake," we are referring to that portion of Mack where water and brominated product are separated by, e.g., filtration and the cake has not been dried or roasted. We are not addressing the "wet" cake later created in the process after treatment with aromatic solvent and crystallization. Applicants' claims all recite that the wet cake comprises water.

1. As stated earlier, the novelty of Mack's invention (according to Mack) lies in the contact of recovered and dry brominated product with aromatic solvent above about 175°C to dissolve the brominated diphenylalkane product, followed by cooling to precipitate an improved product (Col. 1, lines 52-58; Col. 5, lines 56 et seq). On a commercial sale, this is an expensive extra step which, presumably, Mack would have avoided had he known how to produce an improved product without such a step.

2. In addition to color improvement, Mack also says that his products are essentially free from bromine located on the alkylene bridge and that they are highly thermally stable (Col. 2, lines 58-61).

3. Presumably, because of the aromatic solvent treatment, Mack teaches that he can use either highly purified or standard grades of bromine and diphenylalkane starting materials, without adverse impact on the color of the final product (Col. 3, lines 4-10 and 37-41). Impure starting materials are known to have a potentially adverse impact on final color (see applicants' specification, paras. 0014 and 0018 and para. 9 below). The same is true regarding the use of nitrogen (compare applicants' paragraph 0016 with Mack, Col. 4, lines 16-20). What this effectively is saying is that Mack is indifferent to upstream control of such matters as purity of raw materials, use of nitrogen and bromine content because, regardless of what those matters may be, a superior product will be obtained by recrystallation as claimed.

4. According to Mack, the starting materials and catalyst can be "contacted and reacted in any suitable fashion," and there is no suggestion that process conditions and steps could or should be adjusted and coordinated to provide a wet cake of low occluded free bromine content. Again, due to the recrystallation from aromatic solvent, Mack is not concerned with upstream conditions.



5. In the preferred mode, molten diphenylalkane is added to the bromine and catalyst (Col. 4, lines 12-16). There is no teaching in Mack of applicants' important step of adding the diphenylalkane diluted with bromine (see applicants' specification, paras. 0006-0009 and comparative example).

6. According to Mack, isolation of the brominated diphenylalkane product is by "any conventional manner," preferably by contacting the reaction mixture with hot water to distill off any excess bromine (Col. 5, lines 9 et seq). A metal chelating or complexing agent can be included in the hot water to aid in the removal of the catalyst, which thereby improves color characteristics (Col. 5, lines 20-30).

7. The brominated diphenylalkane product of Mack is recovered from the aqueous slurry by filtration and may be washed with water or organic solvents (Col. 5, lines 31-37). This filtration will produce a water/ DBDPE wet cake, but there is no teaching of any occluded free bromine content in this cake, and there is nothing in Mack that would lead one to think that such content could or should be controlled (or how to do so), or that it is important, or that it is of concern, or that it is other than high as would normally be expected.

8. At Col. 5, lines 50-55, Mack teaches that iron catalysts minimize bromination of the alkylene bridge. Mack relates such alkylene bridge bromination (not to be confused with occluded free bromine) with "hydrolysable bromine content," thereby indicating that hydrolysable bromine comprises unwanted bromine on the alkylene bridge. See Col. 7, lines 58-61.

9. Mack references known methods for "obtaining good color" including the use of "purified bromine and/or purified substrate, and roasting of the product." Again, presumably due to his critical aromatic solvent treatment step, roasting is said to be unnecessary in the Mack

procedure (Col. 7, lines 33-37). With or without roasting, Mack's high temperature aromatic solvent recrystallization provides the product Mack desires.

10. Example 1 of Mack (Col. 11, lines 18-55), produces a brominated product, and then distills bromine by contact with hot water. The slurry is filtered and washed with water. No occluded free bromine content of this wet cake is provided. However, after drying, a "tan solid" is obtained with a high "hydrolysable Br" content (alkylene bridge bromination) and a YID of 73.4.

11. Examples 2-4 are similarly conducted but here chelating/complexing agents were added to the hot water and the product was roasted at 200°C for 30 minutes to give "off white" solids with lower hydrolysable Br and YID values. Given the chelation treatment and roasting steps, this lower YID in the dried product is not surprising and cannot be related to the condition of the wet cake and/or its occluded free bromine content (see paragraphs 6 and 9 above).

12. Example 5 of Mack is similar to Example 1 but used purified bromine and DPE starting materials. The water temperature is specified as 99°C to distill bromine and the water also contained sodium gluconate (a chelating) to complex with the iron catalyst (see paragraph 6 above). An "orange solid" was obtained and the YID of dried product was measured at 45. As with Example 1, no roasting occurred, so the YID was higher than that obtained in Examples 2-4.

13. Examples 6-7 are directed to the Mack invention, i.e., they start with the "crude decabromodiphenylethane" product of Example 5 and apply the aromatic recrystallation step. This provides low reported YID and hydrolysable bromine content. However, these values say little, if anything, about the upstream occluded free bromine content of the wet cake, especially

because Mack teaches that no matter what the upstream conditions might be, a good product will be obtained as a result of the solvent treatment.

14. Example 8 is another invention example which treats a "tan solid" produced from "non purified" starting materials with aromatic solvent, yet it still provides a low color product. Nothing is taught about the occluded free bromine content of upstream wet cake.

15. Example 9 obtains a roasted, dried product from purified bromine and DPE but does not treat it with aromatic solvent. As with the prior examples, nothing is said about the occluded free bromine content in the wet cake and the product color is explained by roasting and the use of purified starting materials.

16. Examples 10 through 13 are formulation examples showing the effects of alkylene bridge bromination (DBDPE having no bromines on the alkylene bridge -vs- DBDPE-ABB having a trace amount).

17. The remaining Examples show aqueous dispersions from the Example 8 product (Examples 14 and 16) and a comparison of DBDPE with the corresponding oxide (Example 15).

## **VI. CONCLUSIONS FROM MACK**

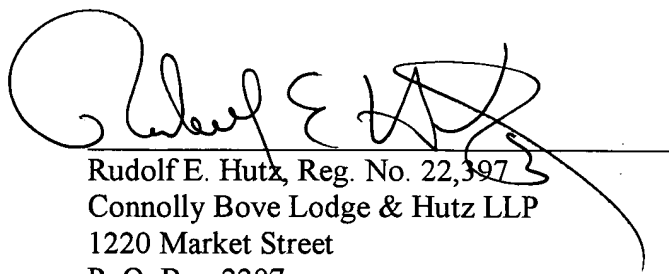
Although Mack teaches different color values and hydrolysable bromine contents for the various products produced by his examples, there is nothing to suggest that these differences are in any way related to the occluded free bromine contents of the upstream water/ DBDPE wet cake. In fact, these different values are explainable due to aromatic solvent treatment, roasting, purified starting materials and/or the use of chelation agents, as explained above and as explained by Mack himself. Moreover, Mack (who is wholly silent about the importance of wet cake occluded free bromine content) expressly teaches that a wide variety of upstream conditions can exist without any impact on ultimate product color because of the aromatic solvent treatment.

Under these circumstances, there is no basis for suggesting that Mack inherently produces a wet cake as claimed and no reason for analyzing or modifying the bromine content of the wet cake (which is produced without the special process steps set forth in applicants' specification). There is no motivation for anyone to focus on the wet cakes of Mack, or to attempt to modify any aspect of them. From Mack's teachings, one would be indifferent to the wet cake and other upstream aspects of the aromatic solvent treatment.

Applicants respectfully submit that the Examiner has not made out a *prima facie* case of obviousness and applicants, therefore, need present no rebuttal evidence. On the present record, all claims are allowable.

A prompt and favorable response is requested. Should the Examiner believe that further discussion, by telephone or in a face-to face interview would advance prosecution, she is urged to contact the undersigned at the telephone number indicated.

Respectfully submitted,



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